

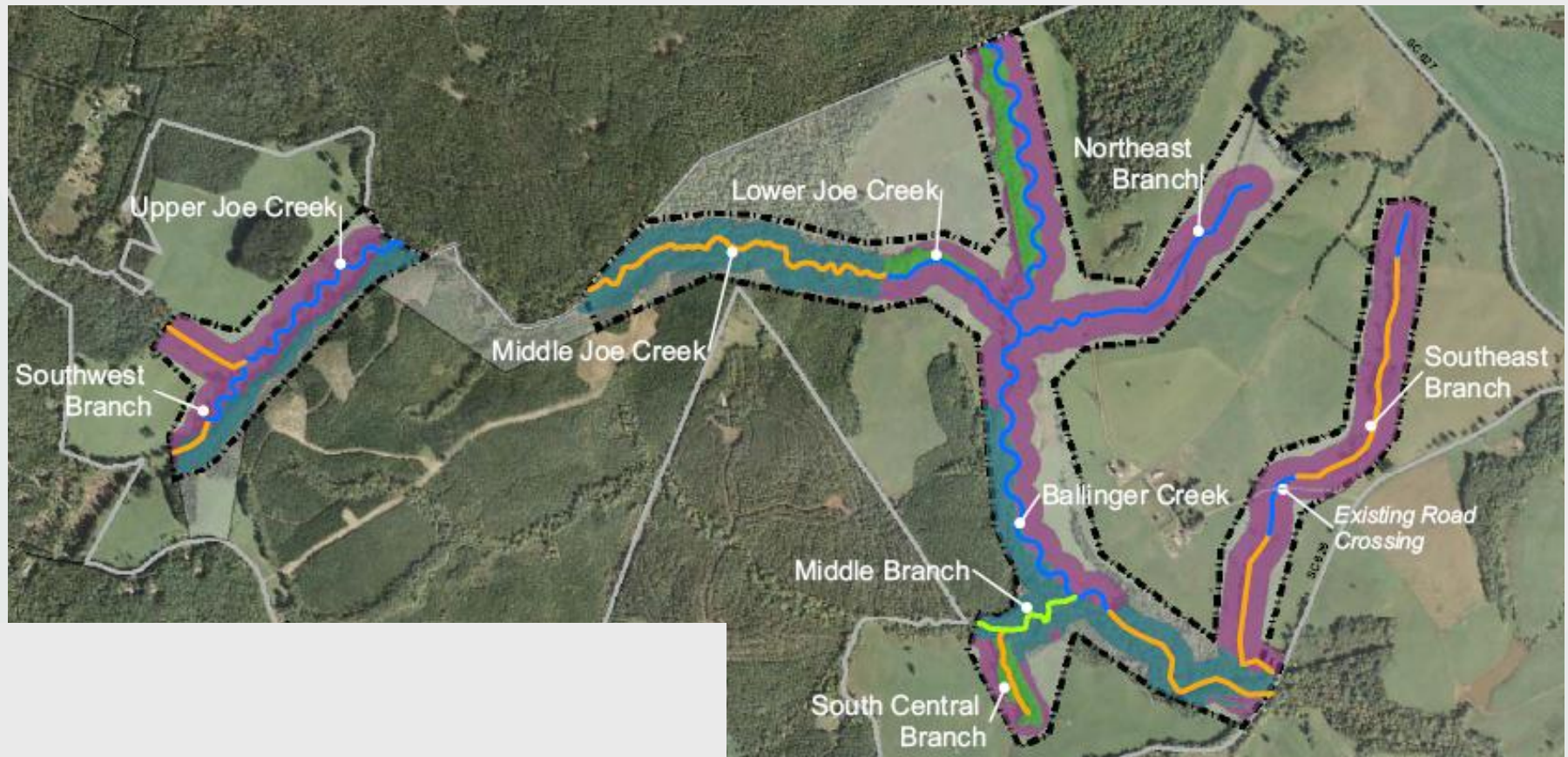


Lone Oak Stream Mitigation Bank



Overview

- 1,400 acre former cattle farm in Southern Albemarle County
- 5.6 miles of stream
 - Ballinger Creek and five of its tributaries
 - 18,219 lf priority I & II Restoration
 - 2,745 lf Enhancement
 - 8,673 lf Preservation
 - 160.5 acres buffer planting
 - 85 acres buffer preservation
- Drainage areas 0.5mi² – 14.9 mi²
- 6 months of construction
- ~37,000 stream credits



Existing Conditions Parameters

- Livestock access
- Limited to no streamside buffer
- Actively eroding vertical banks
- Overwidening with midstream bar deposition
- Laterally unstable meander bends
- Moderately to deeply incised channels with bank height ratios between 1.5- 3.8
- Receiving waters listed for fecal coliform



Existing Conditions



Construction



Priority 1 channel construction



Priority 1 channel construction

Construction



Boulders, bedrock, and logs all provide in-stream habitat and robust channel substrate.



Existing trees were preserved and utilized in the design and construction.

Construction



Northeast pond prior to removal



Northeast pond immediately following removal

Construction



Northeast pond current conditions



Northeast pond current conditions

Construction



Three weeks after completion of construction



5-days after a 3/4 bankfull event. Construction complete. Floodplain has been ripped and is ready for planting.

Construction



Lowe Joe “Restore-hancement”

Innovations – Brush Toe

- Provides excellent outer meander bend protection
- Higher habitat value than rootwads, boulders, and vanes
- Absorbs / reduces near bank stress
- Implications for bendway dynamics?



Innovations – Brush Toe



Brush 'Toe Construction



Innovations – Brush Toe



Brush Toe Completed

Innovations – Brush Toe



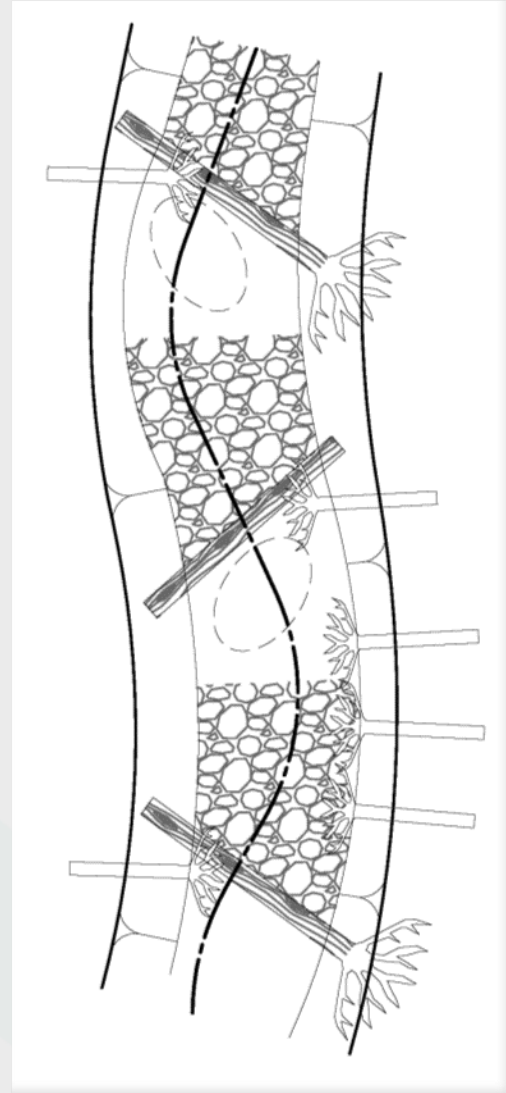
Brush Toe versus Bankfull



Brush Toe One- Bankfull Zero

Innovations – Angled Log Step Pool

- Applying to low gradient systems
- Need at least a couple 10ths drop per log
- Ideal for long tangent sections and slope transitions
- Provides good “holding water” habitat during dry summer months and low base flow conditions.
- Deep vertical scour pool with undercut log drop is cool and dark. Fish prefer.



Innovations – Angled Log Step Pool



During Construction

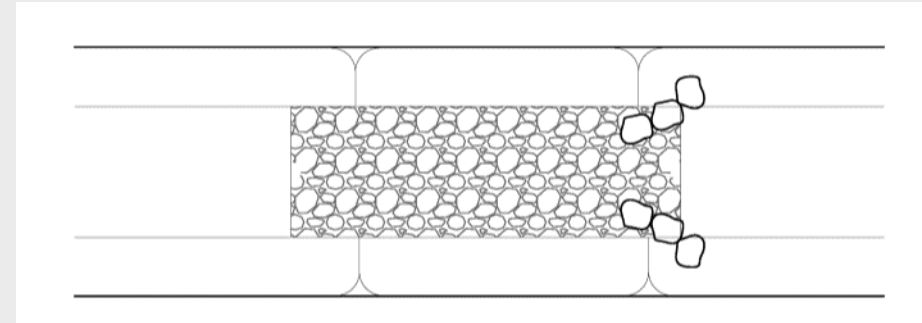


Water On

Innovations – Riffle Types



Jazz Riffle



Boulder Tail Riffle



Field Fits – Bedrock

- Bedrock encountered above max pool depth in two locations along Ballinger
- Stream too low gradient and too far along to adjust profile substantially
- Relatively “soft” and was able to be broken up and excavated to within tolerable range versus reference.
- Rock toe added in area where most departure from design
- Broken up bedrock makes beautiful riffle substrate



Field Fits – Ponds

- Ponds are hard to get to dry out
- Alignment shifted away from center of pond and benched slightly.
- Still kept ER and floodplain access versus design



Field Fits – Enhancement

- Easy at concept stage
- Harder to accomplish in practice
- Reduced number of structures in the original MBI plan set substantially
- Focused on working with existing features and strategically placed structures
- Credit reduction offset by additional restoration in other areas



Lessons Learned – Planting

- In general, buffer establishment has not been strength of the stream restoration industry
- Specifically lack of herbaceous cover from permanent seed on floodplains and banks
- High mortality of planted woody stems
- Had the first issue at Lone Oak but not so much the second. At least not yet.
- Solutions on current designs:
 - Spray pastures with a pre-emergent prior to project construction for as many seasons as possible
 - Plant denser in rows to accommodate wider spacing between rows so buffer can be mowed and sprayed after tree planting. In North Carolina translates to 5' and 10' versus 7' uniform. Continue to overplant
 - Plant early succession “survivor’s” in higher proportions than climax successional species. Can’t shortcut succession
 - Rethink native permanent seed mixes entirely by going with low growing species, nitrogen fixers and species that we know will grow

Lessons Learned – Example Plant Lists

WETLAND/STREAMBANK		
Species Name	Common Name	Density (lbs/acre)
Agrostis stolonifera	Creeping bentgrass	2
Chasmanthium latifolium	River Oats	0.8
Bouteloua curtipendula	Side oats grama	3.6
Bouteloua gracilis	Blue grama	3.6
Panicum clandestinum	Deer tongue	4
Schizachyrium scoparium	Little bluestem	3.6
Carex vulpinoidea	Fox sedge	1.6
Vicia villosa	Hairy vetch	0.8
	Subtotal	20

RIPARIAN		
Species Name	Common Name	Density (lbs/acre)
Agrostis stolonifera	Creeping bentgrass	2
Andropogon ternarius	Split beardgrass	0.4
Bouteloua curtipendula	Side oats grama	2.8
Bouteloua gracilis	Blue grama	3.6
Panicum clandestinum	Deer tongue	3.6
Schizachyrium scoparium	Little bluestem	2.8
Sporobolus clandestinus	Rough dropseed	1.6
Vicia villosa	Hairy vetch	0.8
Chasmanthium latifolium	River Oats	1.6
Carex vulpinoidea	Fox sedge	0.8
	Subtotal	20

TREES		
Species	Common Name	%
Liriodendron tulipifera	Tulip Poplar	20%
Quercus phellos	Willow Oak	10%
Plantus occidentalis	Sycamore	20%
Betula nigra	River Birch	15%
Carpinus caroliniana	Ironwood	5%
Quercus michauxii	Swamp Chestnut Oak	5%
Fraxinus pennsylvanica	Green Ash	20%
Quercus rubra	Northern Red Oak	5%